

CLAIMS:

1           1.     A storage medium containing software for manipulating computer-  
2 implemented objects in a distributed system, the software comprising:

3                 code to create a shared environment, the shared environment  
4 comprising a plurality of objects; and

5                 code to create an object, the object exposed to other objects in the  
6 shared environment, the object comprising:

7                     a set of Behavior logics, each member of the set of Behavior  
8 logics adapted to cause the object to perform a task; and

9                     a first Behavior logic, adapted to receive a Command from  
10 another object in the shared environment, the first Behavior logic  
11 invokable external to the object, the first Behavior logic comprising:

12                         code to receive the Command;

13                         code to select a Behavior logic of the set of Behavior  
14 logics corresponding to the Command from a Command-  
15 Behavior mapping; and

16                         code to execute the selected Behavior logic responsive  
17 to the Command.

1           2.     The storage medium of claim 1, the set of Behavior logics and the  
2 Command-Behavior mapping private to the object.

1           3.     The storage medium of claim 1, the set of Behavior logics having no  
2 members.

1           4.     The storage medium of claim 1, the object further comprising:  
2                 a default Behavior logic, adapted to cause the object to perform a  
3 default task, the default Behavior logic private to the object;  
4 the first Behavior logic further comprising:

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code to execute the default Behavior logic responsive to the Command if no Behavior logic is selected by the code to select a Behavior logic corresponding to the Command.

5. The storage medium of claim 1, wherein the Command-Behavior mapping can cause the code to select a Behavior to select multiple Behaviors.

6. The storage medium of claim 1, the object further comprising:  
an authentication data, the authentication data providable to other objects for authenticating Commands received from the other objects by the code to receive the Command.

7. The storage medium of claim 6, wherein the Command comprises the authentication data, the Command-Behavior mapping restrictable responsive to the authentication data.

8. The storage medium of claim 1, the software further comprising:  
code to create a first Shadow of the object, the first Shadow of the object adapted to communicate with the object, the first Shadow of the object being informed of changes to the object and the object being informed of changes to the first Shadow of the object.

9. The storage medium of claim 8, wherein the first Shadow of the object is a copy of the object.

10. The storage medium of claim 8, wherein the Command-Behavior mapping of the first Shadow of the object differs from the Command-Behavior mapping of the object.

11. The storage medium of claim 8, the software further comprising:

code to create a plurality of Shadows of the object adapted to communicate with the object and the first Shadow of the object, the object and the first Shadow of the object being informed of changes to any of the plurality of Shadows of the object and each of the plurality of Shadows of the object being informed of changes to the object and changes to the first Shadow of the object.

12. The storage medium of claim 8, the software further comprising:  
code to promote the first Shadow of the object into a new object.

13. The storage medium of claim 12, the software further comprising:  
code to create a plurality of Shadows of the object,  
wherein executing the code to promote the first Shadow of the object  
into a new object converts each of the plurality of Shadows of the object into a  
Shadow of the new object.

14. The storage medium of claim 12, the shared environment further comprising:

a plurality of servers, the object on a first server of the plurality of servers, the first Shadow of the object on a second server of the plurality of servers; and

code to manage the plurality of servers, executing the code to promote the first Shadow of the object to a new object if the first server experiences a predetermined condition.

15. The storage medium of claim 1, the set of Behavior logics further comprising:

code to modify the Command-Behavior mapping to cause the code to select a Behavior logic responsive to the Command to select a different Behavior logic of the set of Behavior logics.

1 16. The storage medium of claim 1, the shared environment comprising:  
2 a plurality of servers, the object having a location on one of the  
3 plurality of servers, the object acting independent of the location.

1 17. The storage medium of claim 1, the object further comprising:  
2 code to create the Command-Behavior mapping from an external data  
3 source.

1 18. The storage medium of claim 1, the software capable of using any  
2 networking protocol.

1 19. A method of manipulating a computer-implemented object in a  
2 distributed system, the method comprising the steps of:  
3 creating a shared environment; the shared environment comprising a  
4 plurality of objects; and  
5 creating an object, the object exposed to other objects in the shared  
6 environment, the step of creating an object comprising the step of:  
7 coding a set of Behavior logics, each member of the set of  
8 Behavior logics causing the object to perform a task;  
9 manipulating the object, comprising the steps of:  
10 receiving a Command from another object of the plurality of  
11 objects in the shared environment;  
12 selecting a Behavior logic of the set of Behavior logics  
13 corresponding to the Command from a Command-Behavior mapping;  
14 and  
15 executing the selected Behavior logic responsive to the  
16 Command.

1 20. The method of claim 19, wherein the set of Behavior logics and the  
2 Command-Behavior mapping are private to the object.







1           38.    The method of claim 37, each of the plurality of objects having a  
2           location on one of a plurality of servers, each of the plurality of objects being  
3           independent of the location of each other of the plurality of objects.

1           39.    The method of claim 38, a Shadow of each of the plurality of objects  
2           automatically created on each of the plurality of servers other than the server on  
3           which the object is located.

1           40.    A processor-based system, comprising:  
2           a first processor; and  
3           a first storage device coupled to the first processor containing a  
4           software to manipulate computer-implemented objects in a shared  
5           environment, the software comprising:  
6                code to create a shared environment, the shared environment  
7                comprising a plurality of objects; and  
8                code to create an object of the plurality of objects, the object  
9                exposed to other objects in the shared environment, the object  
10              comprising:  
11                a set of Behavior logics, each member of the set of  
12                Behavior logics adapted to cause the object to perform a task;  
13                and  
14                a first Behavior logic, adapted to receive a Command  
15                from another object in the shared environment, the first  
16                Behavior logic invokable external to the object, the first  
17                Behavior logic comprising:  
18                   code to receive the Command;  
19                   code to select a Behavior logic of the set of  
20                   Behavior logics corresponding to the Command from a  
21                   Command-Behavior mapping; and  
22                   code to execute the selected Behavior logic  
23                   responsive to the Command.



41. The processor-based system of claim 40, the object further comprising:  
a default Behavior logic, adapted to cause the object to perform a  
default task, the default Behavior logic private to the object;  
the first Behavior logic further comprising:  
code to execute the default Behavior logic responsive to the Command  
if no Behavior logic is selected by the code to select a Behavior logic  
corresponding to the Command.

42. The processor-based system of claim 40, wherein the Command-Behavior mapping can cause the code to select a Behavior logic to select multiple Behaviors.

43. The processor-based system of claim 40, further comprising:  
an input device coupled to the first processor,  
wherein a first object of the plurality of objects is coupled to the input device such that manipulation of the input device sends a Command from the first object to a second object of the plurality of objects without identifying the input device, the second object of the plurality of objects acting responsive to the Command independent of the nature of the input device.

44. The processor-based system of claim 40, further comprising:  
an output device coupled to the first processor,  
wherein a first object of the plurality of objects is coupled to the input  
device such that a first object is capable of rendering a second object on the  
output device without identifying the output device to the second object.

45. The processor-based system of claim 40, further comprising:  
a second processor;  
a network, coupled to the first processor and the second processor;  
a second storage device coupled to the second processor, the second storage device containing the software;

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6 the software further comprising:  
7 code to connect the shared environment to the network;  
8 code to create a Shadow on the second processor of the object  
9 on the first processor, the Shadow and the object communicating with  
10 each other to inform the Shadow of changes to the object and the  
11 object of changes to the Shadow.

1 46. A software architecture for manipulating computer-implemented  
2 objects on a plurality of computers, some of the plurality of computers having input  
3 devices and some of the plurality of computers having output devices, the software  
4 architecture implemented in an extensible object-oriented language, comprising:

5 a distributed system, comprising:  
6 a plurality of shared environments, each of the plurality of  
7 shared environments executing on a different computer of the plurality  
8 of computers, each of the plurality of shared environments comprising:

9 a CommandReceiver class, the CommandReceiver class  
10 comprising:

11 a set of Behavior private methods, each member  
12 of the set of Behavior methods adapted to cause  
13 instantiations of the CommandReceiver class to perform  
14 a task; and

15 an executeCommand public method, adapted to  
16 receive a Command from an object in the shared  
17 environment, the executeCommand public method  
18 comprising:

19 code to receive the Command;  
20 code to select a Behavior private method  
21 of the set of Behavior private methods selected  
22 corresponding to the Command from a  
23 Command-Behavior mapping; and

code to execute the selected Behavior  
private method; and  
a Kernel subclass of the CommandReceiver class, the  
Kernel class comprising:  
code to instantiate objects of the  
CommandReceiver class;  
code to destroy objects of the  
CommandReceiver class.

47. The software architecture of claim 46, further comprising:  
a Pawn subclass of the CommandReceiver class, the Pawn subclass comprising:  
code to register an instantiation of a Pawn with a Kernel object of the Kernel subclass;  
code to determine whether an instantiation of the Pawn subclass is a real Pawn or a Shadow Pawn of a real Pawn, and  
code to send State information about an instantiation of the Pawn subclass,  
wherein Commands received by Shadow Pawns are sent to the real Pawn corresponding to the Shadow Pawn.

48. The software architecture of claim 46, further comprising:  
a ControlDevice subclass of the CommandReceiver class corresponding to an input device for receiving input from the input device and sending Commands to other CommandReceiver objects.

49. The software architecture of claim 46, further comprising:  
a Construct subclass of the CommandReceiver class corresponding to an output device for rendering objects of the CommandReceiver class with graphical attributes.

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1           50.     The software architecture of claim 46, further comprising:  
2                 a Console subclass of the CommandReceiver class for allowing a user  
3     of the distributed system to instantiate, modify, and destroy objects, and for  
4     allowing a user to send Commands to CommandReceiver objects.

1           51.     The software architecture of claim 46, further comprising:  
2                 a Nengine subclass of the CommandReceiver class for serializing and  
3     deserializing CommandReceiver objects, transmitting and receiving the  
4     serialized CommandReceiver object across a network to a Nengine in another  
5     shared environment of the distributed system.

1           52.     The software architecture of claim 51, further comprising:  
2                 a Node subclass of the CommandReceiver class, an instantiation of the  
3     Node subclass corresponding to a Pawn object for representing the Pawn  
4     object to a Nengine object for communicating State information corresponding  
5     to a Pawn to Shadow Pawns of the Pawn and for communicating Commands  
6     sent to a Shadow Pawn to the real Pawn corresponding to the Shadow Pawn.